

REMARKS

Claims 1-24 are currently pending in the present patent application. In an Office Action mailed March 14, 2005, the Examiner allowed claims 1-14 and rejected claims 15-24. Claim 15, 18-19, and 22 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application No. 3,992,079 to Giallorenzi ("Giallorenzi"), rejected claims 23 and 24 under 35 U.S.C. §103(a) as being unpatentable over Giallorenzi, and rejected claims 16-17 and 20-21 under Section 103(a) as being unpatentable over the combination of Giallorenzi and U.S. Patent Nos. 3,948,583 to Tien ("Tien") and 5,124,543 to Kawashima ("Kawashima").

Amended claim 15 recites an optical integrated circuit formed on a substrate, and including a lower optical transmission layer formed over the substrate and a first cladding layer having an angled sidewall formed on the first optical transmission layer. The sidewall has an angle relative to the lower optical transmission layer. A second optical transmission layer is formed on the lower optical transmission layer and on the angled sidewall of the first cladding layer. The second optical transmission layer has an angle relative to the lower optical transmission layer that is defined by the angle of the angled sidewall, with the angle having a value between five degrees and a maximum angle having a value defined by ~~indices-of-refraction-of-the-second-optical-transmission-layer-and-the-first-cladding-layer.~~ Light having a same mode as light propagating through the lower optical transmission layer propagates through the second optical transmission layer through total internal reflection.

One embodiment of the present invention is illustrated in Figure 2F, which shows an optical transmission layer 204a coupled to a second optical transmission layer 220 having a vertical optical interconnect 222 formed on an angled sidewall 218 coupled to an upper optical transmission layer 224. As explained with reference to this embodiment, light having a given mode and a wavelength λ propagates through the layers 204a and 220 and then through the vertical optical interconnect 222 and into the layer 224. See paragraph 21. The light is confined in the vertical optical interconnect 222 through total internal reflection. *Id.* The angled sidewall 218 has an angle such that light propagating through the layers 204a, 220 is incident upon a boundary between the optical interconnect 222 and the cladding layer 208 at an angle that is equal to or less than a critical angle defined between the boundary and the incident light.

The Giallorenzi patent, in contrast, discloses a thin film waveguide 11 and branching waveguide 12 that function as a mode filter, with optical radiation of a first mode propagating

through the waveguide 11 and radiation of a different mode propagating through the branching waveguide. This is the intended operation of the structure of Giallorenzi and there is no disclosure or suggestion of forming the branching waveguide so that light of a given mode propagates through waveguides 11 and 12. Having light of the same mode propagating through the branching waveguide is thus contrary to the function of the Giallorenzi structure. In the embodiment of Figure 2F, the angle of the sidewall 218 and thus the optical interconnect 222 is such that light of a given mode propagates through layers 204a, 220 and through the interconnect through total internal reflection, which is contrast to the structure of the Giallorenzi patent.

Moreover, none of the other prior art references of record discloses the recited combination of elements in amended claim 15. For example, in the Tien patent the "key concept is the isolation of the high index substrate, necessary to active devices, wherever it is desired to have a passive device." See, e.g., Abstract. Thus, the whole purpose of the SiO₂ layer 12 is merely to isolate the GaAs layer 14 in desired places. A thin layer of SiO₂ is required for such isolation and thus Tien discloses only a very small angle defined by a 60:1 slope. There is no suggestion in Tien for other than a very gradual slope, which means a very small angle of the sidewall. In fact, Tien expressly states the taper of the sidewall "must have a very gentle taper," see Col. 3, line 5, and the example given in the next line is a slope of 60:1 for the taper. Thus, the angle of the sidewall in Tien is only contemplated as being very small (60:1 translates into an angle of less than 1 degree) and not having a value between five degrees and a maximum angle having a value defined by indices of refraction of the second optical transmission layer and the first cladding layer. These indices of refraction, of course, define the critical angle for total internal reflection.

For all these reasons, the combination of elements in amended claim 15 is allowable. Amended independent claims 18 and 22 are allowable for reasons similar to those discussed above with reference to claim 15. All claims depending from claims 15, 18, and 22 are allowable for at least the same reasons the independent claim from which each depends and due to the additional limitations added by each of these dependent claims.

The present patent application is in condition for allowance. Favorable consideration and a Notice of Allowance are respectfully requested. Should the Examiner have any further questions about the application, Applicant respectfully requests the Examiner to contact the undersigned attorney at (425) 455-5575 to resolve the matter. If any need for any additional fee is found, for any reason or at any point during the prosecution of this application, kindly consider this a petition therefore and charge any necessary fees to deposit account 07-1897.

DATED

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Respectfully submitted,

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